

What is claimed is:

- 1) A rigid-flex printed circuit board system comprising, in combination:
  - a) at least one rigid layer;
  - b) at least one flexible layer bonded to at least one portion of said at least one rigid layer;
  - c) wherein said at least one rigid layer comprises at least one structural weakness at at least one selected location;
  - d) wherein said at least one structural weakness is adapted to facilitate breaking said at least one rigid layer at such at least one selected location into at least two pieces to provide a flexible connection formed by said at least one flexible layer between such pieces.
- 2) The rigid-flex printed circuit board system according to Claim 1 wherein such structural weakness comprises at least one score.

- 3) The rigid-flex printed circuit board system according to Claim 1 wherein:
- a) said at least one rigid layer comprises
    - i) at least one top side, and
    - ii) at least one bottom side;
  - b) said structural weakness comprises
    - i) at least one score on said at least one top side at such at least one selected location, and
    - ii) at least one score on said at least one bottom side at such at least one selected location.
- 4) The rigid-flex printed circuit board system according to Claim 1 wherein said structural weakness comprises at least one gap at such selected location between said at least one rigid layer and said at least one flexible layer.
- 5) The rigid-flex printed circuit board system according to Claim 1 further comprising:
- a) at least one adhesive to bond at least one portion of said at least one flexible layer to at least one portion of said at least one rigid layer;
  - b) wherein said structural weakness comprises selective absence of adhesive at such selected location between said at least one rigid layer and said at least one flexible layer.

- 6) The rigid-flex printed circuit board system according to Claim 1 wherein said structural weakness comprises at least one laser score.
- 7) The rigid-flex printed circuit board system according to Claim 1 wherein said structural weakness comprises at least one mechanical score.
- 8) The rigid-flex printed circuit board system according to Claim 1 wherein said at least one rigid layer comprises epoxy.
- 9) The rigid-flex printed circuit board system according to Claim 1 wherein said at least one rigid layer comprises metal.
- 10) The rigid-flex printed circuit board system according to Claim 1 wherein said at least one rigid layer comprises fiberglass.
- 11) The rigid-flex printed circuit board system according to Claim 1 wherein said at least one flexible layer comprises polyimide.

- 12) The rigid-flex printed circuit board system according to Claim 1 wherein:
- a) said at least one flexible layer comprises
    - i) at least one substantially flexible insulating layer, and
    - ii) at least one substantially flexible conductive layer; and
  - b) said at least one rigid layer comprises
    - i) at least one substantially rigid insulating layer, and
    - ii) at least one conductive layer.
- 13) A rigid-flex printed circuit board system comprising, in combination:
- a) at least one substantially rigid layer;
  - b) at least one substantially flexible layer bonded to at least one portion of said at least one substantially rigid layer;
  - c) wherein said at least one substantially rigid layer comprises at least one structural weakness at at least one selected location to facilitate bending said at least one rigid layer at such at least one selected location to provide at least one flexible connection.

- 14) The rigid-flex printed circuit board system according to Claim 13 wherein said at least one substantially rigid layer comprises metal.
- 15) The rigid-flex printed circuit board system according to Claim 13 wherein said at least one substantially rigid layer comprises aluminum.
- 16) The rigid-flex printed circuit board system according to Claim 13 wherein said at least one structural weakness comprises at least one groove.
- 17) The rigid-flex printed circuit board system according to Claim 13 wherein said at least one structural weakness comprises at least one chemically milled groove.
- 18) A process of fabricating a rigid-flex printed circuit board system comprising the steps of:
  - a) bonding at least one portion of at least one flexible layer to at least one portion of at least one rigid layer;
  - b) peeling at least one portion of such at least one flexible layer away from such at least one rigid layer, at at least one selected location, to provide at least one flexible circuit portion.

- 19) The process of fabricating a rigid-flex printed circuit board system according to Claim 18 further comprising the step of structurally weakening at least a portion of such flexible layer to assist in such peeling.
- 20) The process of fabricating a rigid-flex printed circuit board system according to Claim 18 further comprising the step of cutting at least one portion of such flexible layer to assist in such peeling.
- 21) The process of fabricating a rigid-flex printed circuit board system according to Claim 18 wherein:
  - a) such bonding comprises selectively applied adhesive;
  - b) such adhesive is selectively applied to substantially omit adhesive from being applied, at such at least one selected location, between such at least one flexible layer and such at least one rigid layer to assist in such peeling.

- 22) The process of fabricating a rigid-flex printed circuit board system according to Claim 18 further comprising the steps of:
- a) applying an adhesive to form such bonding;
  - b) selectively removing at least one portion of such adhesive, at such at least one selected location, between such at least one flexible layer and such at least one rigid layer to assist in such peeling.
- 23) A process of fabricating a rigid-flex printed circuit board system comprising the steps of:
- a) bonding at least one portion of at least one flexible layer to at least one portion of at least one rigid layer;
  - b) breaking at least one portion of such at least one rigid layer, at at least one selected location, into at least two pieces;
  - c) wherein such at least one flexible layer provides a flexible connection, at such at least one selected location, between such at least two pieces.

- 24) The process of fabricating a rigid-flex printed circuit board system according to Claim 23 further comprising the step of structurally weakening, at such at least one selected location, at least one portion of said at least one rigid layer to assist in such breaking.
- 25) The process of fabricating a circuit board system according to Claim 23 further comprising the step of scoring such at least one rigid layer, at such at least one selected location, to assist in such breaking.
- 26) The process of fabricating a rigid-flex printed circuit board system according to Claim 25 wherein such scoring comprises a process selected from the group consisting of
- a) laser scoring
  - b) mechanically scoring
  - c) mechanically punching.
- 27) The process of fabricating a rigid-flex printed circuit board system according to Claim 23 further comprising the steps of:
- a) applying an adhesive to form such bonding;
  - b) selectively removing at least a portion of such adhesive, at such at least one selected location, between such flexible layer and such rigid layer to assist in such breaking.



- 28) The process of fabricating a rigid-flex printed circuit board system according to Claim 23 wherein:
- a) such bonding comprises selectively applied adhesive;
  - b) such adhesive is selectively applied to substantially omit adhesive from being applied, at such at least one selected location, between such flexible layer and such rigid layer to assist in such breaking.
- 29) A process of fabricating a rigid-flex printed circuit board system comprising to steps of:
- a) bonding at least one flexible layer to at least one rigid layer;
  - b) wherein such flexible layer comprises a conductive layer;
  - c) etching said flexible layer after such flexible layer has been bonded to such outer surface of such rigid layer;
  - d) breaking, at a selected location, at least one portion of such rigid layer into at least two rigid pieces after such flexible layer has been bonded to such outer surface of such rigid layer;
  - e) wherein such flexible layer provides a flexible connection, at the location of the break, between such pieces of such rigid layer.

- 30) The process of fabricating a rigid-flex printed circuit board system according to Claim 29 further comprising the step of selective removal of at least a portion of said rigid layer to assist in such breaking.
- 31) The process of fabricating a rigid-flex printed circuit board system according to Claim 30 wherein at least one laser is used to accomplish at least a portion of such selective removal.
- 32) The process of fabricating a rigid-flex printed circuit board system according to Claim 30 wherein mechanical abrasion is used to accomplish at least a portion of such selective removal.
- 33) The process of fabricating a circuit board system according to Claim 30 wherein mechanical impact is used to accomplish at least a portion of such selective removal.
- 34) The process of fabricating a rigid-flex printed circuit board system according to Claim 29 further comprising the step of selectively removing at least a portion of said rigid layer, before bonding such at least one flexible layer to at least one outer surface of such rigid layer, to assist in such breaking.

- 35) The process of fabricating a rigid-flex printed circuit board system according to Claim 29 further comprising the step of selectively removing at least a portion of adhesive between such flexible layer and such rigid layer to assist in such breaking.
- 36) The process of fabricating a rigid-flex printed circuit board system according to Claim 29 wherein:
- a) such flexible layer is bonded to such rigid layer with an adhesive layer;
  - b) such adhesive layer is selectively applied to avoid placing adhesive at such selected location.
- 37) The process of fabricating a rigid-flex printed circuit board system according to Claim 29 wherein:
- a) such rigid layer comprises material selected from the group consisting essentially of
    - i) tri-functional epoxy resin
    - ii) multifunctional epoxy resin
    - iii) fiberglass reinforced material
    - iv) cast coated non-reinforced epoxy resin
    - v) cast coated non-reinforced polyimide resin
    - vi) aluminum
    - vii) copper
    - viii) semiconductor.

- 38) The process of fabricating a rigid-flex printed circuit board system according to Claim 29 wherein:
- a) such flexible layer comprises material selected from the group consisting essentially of
    - i) polyimide film
    - ii) poly-ethylene naphtalate film
    - iii) polyester film
    - iv) liquid crystal polymer film
    - v) fiberglass reinforced epoxy.
- 39) A process of fabricating a rigid-flex printed circuit board system comprising the steps of:
- a) laminating at least one portion of at least one flexible layer to at least one portion of at least one rigid layer;
  - b) plating, imaging, and etching at least one portion of such at least one flexible layer to form conductor patterns after such at least one portion of at least one flexible layer has been laminated to such at least one portion of at least one rigid layer;
  - c) breaking at least one portion of such at least one rigid layer, at at least one selected location, into at least two pieces;

- d) wherein such at least one flexible layer provides a flexible conductive connection, at such at least one selected location, between such at least two pieces.
- 40) A rigid-flex printed circuit board system comprising, in combination:
- a) insulating means for electrically insulating conductive portions of the rigid-flex printed circuit board;
  - b) conducting means for conducting electricity through portions of the rigid-flex printed circuit board;
  - c) rigidity means for providing rigidity to all portions of said conducting means;
  - d) conversion means for converting portions of rigidity means into a flexible means for flexing portions of said conductor means.
- 41) The rigid-flex printed circuit board system according to claim 40 wherein said conversion means comprises structural weakness means for structurally weakening selected portions of said rigidity means.